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Illness severity assessment for children with RTI: do parents and GPs agree?

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Abstract (N=250)

Background

Children's respiratory tract infection (RTI) severity assessments are known to differ between parents and clinicians, but determinants are unknown.

Aim

To investigate the agreement between, and compare the determinants of, parent and clinician severity scores.

Design and Setting

Secondary analysis of data from a prospective cohort study of 8394 children aged 3 months to 16 years presenting to primary care with acute (≤28 days) cough and RTI.

Method

Data on sociodemographic factors, parent reported symptoms, clinician reported physical examination findings and global illness severity assessments was used . Kappa statistics used to investigate agreement and multivariable logistic regression to identify the factors associated with illness severity.

Results

Parents reported higher (mean 5.2 (SD= 1.8), median 5 (IQR 4-7)) illness severity than clinicians (mean 3.1 (SD= 1.7), median 3 (IQR 2-4), p<0.0001). There was low positive correlation between these scores (+0.43) and poor inter-rater agreement between parents and clinicians (kappa 0.049). Number of clinical signs was highly correlated with clinician scores (+0.71). Parent reported symptoms (in the past 24 hours) independently associated with higher illness severity scores (in descending order of importance) were severe fever, severe cough, breathing quickly, severe reduced eating, severe reduced fluid, severe disturbed sleep and change in cry. Three of these symptoms (severe fever, breathing quickly and change in cry) along with inter/subcostal recession, crackles/crepitations, nasal flaring, wheeze and drowsiness/irritability were associated with higher clinician scores.

Conclusions

Clinicians and parents use different factors and make different judgements about children's RTI severity. Improved understanding of the factors concerning parents could improve parent-clinician communication and consultation outcomes.

Keywords

Primary health care, illness severity assessment, respiratory tract infection, fever

How this fits in

Parents' medical advice seeking decisions are complex. An improved mutual understanding of the factors associated with illness severity assessment could facilitate better parent-clinician communication and improved parental understanding regarding the symptoms necessitating consultation.

Introduction

Respiratory tract infections (RTIs) are the most common reason parents take children to primary care worldwide,(1) and many are unnecessarily prescribed antibiotics. The decision to seek medical advice is complex(2, 3),as parents rely on the child's physical expression of illness and their own interpretation of the symptoms.(4) Clinicians also report consultations for RTIs as complex as they manage clinical uncertainly regarding diagnosis and prognosis, which often results in 'just in case' antibiotic prescribing.(5)

Patient-centred care has been shown to improve the quality of doctor-patient communication, consultations and illness outcomes.(6) Reaching a shared understanding of the nature of the problem and its severity is central to patient-centred care.(7, 8) 'Illness severity' can best be referred to as the magnitude of the patient-perceived, clinically significant manifestations of disease processes that are associated with decrements in health related quality of life (HRQOL) or health status.(9) In children's consultations, there are three interacting perceptions (child-parent-clinician) affecting illness severity assessment, with assessments likely to differ due to different factors taken into account.

Parent perceived severe illness in children with a RTI is one of the reasons parents choose to consult to primary care (10), and clinician illness severity assessment might be the guiding factor for antibiotic treatment choice. Misinterpretation of the child's illness severity might not only lead to over-consultation but also to over-treatment. Therefore, in-depth knowledge of the differences in the factors that determine illness severity assessment and particularly (dis)agreement between parents and clinician's assessments may be important in improving parent-clinician communication and management of children with RTI in primary care.

Our study aimed to: (1) investigate (dis) agreement between clinicians' and parents' illness severity scores; and (2) identify and compare the determinants of high parent and clinician severity scores in children presenting to primary care with cough and RTI.

Methods

Design and study population

Data were used from the 'TARGET' study (11), a multicentre prospective cohort study of children with acute (≤28 days) cough and RTI recruited between July 2011 and May 2013. The design of this study has been described in detail and the main results have been published.(11, 12)

Briefly, family physicians and prescribing nurse practitioners (hereafter referred to as 'clinicians') working in primary care centres (GP practice, Walk-in centres, GP Out of Hours centres or polyclinics) were recruited and trained by four UK hubs (Bristol, London, Oxford, and Southampton). They recruited children to the study if they were eligible, defined as aged between 3 months and 16 years and presented with the main symptom of acute (≤28 days) cough with other RTI symptoms (such as fever and coryza). Children with an infected exacerbation of asthma and those who were severely unwell (e.g. requiring same day hospital assessment or admission) were included.

Children were excluded if they presented with a non-infective exacerbation of asthma, were at high risk of serious infection (immunocompromised, for example with cystic fibrosis), required a throat swab for clinical management (which were taken for research purposes in a subgroup of children), had been previously recruited to the study, recently participated in other research, or had temporarily registered at the practice.

Measurements

After obtaining informed consent, clinicians completed a structured online (or paper) case report form (CRF) (appendix 1). The form recorded eight sociodemographic and four illness history/trajectory items, 33 parent-reported symptoms (including whether mild, moderate, or severe in the previous 24 hours), 14 physical examination signs (including vital signs), and the prescription of antibiotics (immediate or delayed) or referral to secondary care for acute assessment. Children's diagnosis of

current asthma was checked via a medical notes review, which was deemed present if asthma was noted in the medical notes and asthma medication was issued in the previous 12 months.

The Indices of Multiple Deprivation (IMD) (Source: National Statistics / Ordnance Survey Extracts) ranges from around zero (least deprived) to >90 (most deprived). Postcodes were used for the IMD.

Illness severity was measured independently by parents and clinician using a zero to ten visual-analogue scale(13), with zero being 'well' and ten being 'very unwell'.

Treatment of variables

Illness severity scores

In the main analysis children were coded as having 'high parent reported illness severity' if their parent severity score was in the upper quartile (a score of ≥7). Similarly, 'high clinician reported illness severity' was coded if clinician score was in the upper quartile (a score of ≥4). For sub-analysis three Illness severity groups were used to determine agreement between parent and clinician scores: (1) parents score < clinician score ('less ill'); (2) parents score = clinician score; and (3) parent score > clinician score ('more ill').

Symptom severity

For symptom severity (mild, moderate, severe) in the 24 hours prior to consultation the dichotomy for each variable was split depending on the prevalence, to either 'severe' if at least 5% of the whole cohort fell into this category or 'moderate and severe' if the proportion was smaller than this.

Clinical cut-offs

In case of dichotomising, commonly used clinical cut-offs were used for continuous data where possible (e.g. temperature >37.8°C) and age-related heart rate, respiratory rate and oxygen saturations were coded as raised or normal/low according to the Paediatric Life Support Manual, 2005.(14)

Data analysis

We compared parent and clinician illness severity scores using a non-parametric approach (as Figure 1 sows the clinician score data was heavily skewed' so a non-parametric approach that makes no assumption about distribution was chosen) for unpaired data, using medians and inter-quartile ranges [IQR] and the Mann-Whitney test to investigate differences between groups (lower/equal/higher).

To determine the association between the number of symptoms and signs reported on the global scores, correlation was determined between the parental illness severity score and the number of parent-reported symptoms, and between the clinician illness severity score and the number of symptoms and signs (both separately and added together). Correlation and agreement were calculated using Spearman's rho and Kappa statistics respectively. To control for anchoring, the rounded mean difference between the parental score and the clinician score was added to the clinician score and the Kappa recalculated.

We used univariable and multivariable logistic regression to identify the sociodemographic and clinical factors independently associated with parent and clinician reported illness severity. Multivariable models were derived through several iterations using backward stepwise logistic regression including all variables significant in the univariable analyses ($p<0.01$) where missing data was <1%. We controlled for age, gender and ethnicity, as well as the presence of other symptoms or signs already in the model.

Two separate multivariable models were determined for high clinician score, one including demographic and symptoms (for comparison with the parental model) and one including demographics, symptoms and signs. The second clinician model included a combined variable for

parent-reported severe fever OR clinician measured temperature ≥37.8°C, and combined variable for parent-reported breathing quickly OR clinician measured raised respiratory rate.

The final models were built in the following order: (1) sociodemographic, (2) clinical history, (3) parents reports symptoms and (for clinician model two) (4) clinical examination.

To reduce the problem of multiple comparisons in the analysis, the listed symptoms (CRF/Appendix 1) were only tested in terms of whether the symptom was present during the illness and whether the symptom was moderate or severe in the last 24 hours.

Results

Descriptive statistics

We recruited 8394 children to the study across the four centres. There was no difference in parental illness severity score between the 164 children declining participation (median 3, IQR 2-4) and the final recruited sample (median 3, IQR 2-4).

Children's median age was 3 years [IQR: 1-6 years] with 1392 (16.6%) under one year old (Table 1). 52% were boys, 78% were white, mother's median age at the child's birth was 30 and 18% of recruited children's mothers were current smokers. Families' median deprivation score was 16.7 (IQR 8.8-29.5). Ethnicity, deprivation score and prevalence of maternal smoking were similar to national figures.(15, 16) The median illness duration prior to consultation was five days [IQR 3-10 days, range 0-28 days] and the median number of parent-reported symptoms was 7 (range 1-16, IQR 5-9) prior to consultation and 6 (range 0-16, IQR 4-8) within 24 hours of the consultation.

Illness severity

8360 (99.6%) children had complete parent and clinician illness severity score data. Parent severity scores (mean 5.2 (SD= 1.8), median=5, range 0-10, IQR 4-7) were higher ($p<0.0001$) than clinician scores (mean 3.1 (SD= 1.7), median 3, range 0-9, IQR 2-4, Figure 1, Table 2). Parents only scored illness severity lower than clinicians in 6% of the children, the same in 15% and higher in 79% (Table 2).

We found evidence of a low positive correlation (Spearman's r: 0.43, p=<0.001) and poor inter-rater agreement between the parental- and clinician illness severity scores (Kappa 0.049, Figure 2), the parental scores and the number of parent-reported symptoms (Spearman's r: 0.37), and the clinician scores and the number of parent-reported symptoms (Spearman's r: 0.34). The clinician scores and the number of clinical signs are strongly positive correlated (Spearman's r: 0.71) and moderate positive correlation was found between clinician scores and the number of parent-reported symptoms

plus the number of clinical signs (Spearman's r: 0.60). Anchor controlling for the inter-rater agreement did not improve the Kappa (0.064, Figure 2).

Univariable analyses

All but one variable (oxygen saturation) had <1% data missing. There was no evidence of differences between children with high parent illness scores compared to those with low scores regarding age, gender, ethnicity, number of consultations in the previous 12 months and current asthma. There was no evidence of differences between children with high clinician illness scores compared to those with low scores regarding ethnicity, number of consultations in the previous 12 months and parent-reported moderate-to-severe diarrhoea. Table 3 summarises the sociodemographic and clinical factors that were associated with higher and lower parent and clinician scores.

Multivariable analyses

Parent severity scores

The model included 8208/8394 (97.8 %) of the children in the cohort. Eight predictors were strongly associated with parent severity scores at p<0.001: one demographic variable (two or more children at home (OR:1.28, 95%CI:1.15-1.44)), and seven parent-reported symptoms ((n order of importance: severe fever (OR:2.58, 95%CI:2.12-3.13), severe dry cough (OR:1.93, 95%CI:1.60-12.34), breathing quickly (OR:1.88, 95%CI:1.69-2.10), severe reduction in eating (OR:1.26, 95%CI:1.26-1.98), moderate to severe reduced fluid intake (OR:1.55, 95%CI:1.34-1.80), severe disturbed sleep (OR:1.32, 95%CI:1.14-1.52) and change in cry (OR:1.30, 95%CI:1.13-1.49)). Together these gave an area under the ROC curve (AUROC) of 0.68 (95% C.I. 0.66-0.69, Table 4).

Clinician severity scores

Two multivariable regression models were derived, one model to compare to the parental model including demographics and parent reported symptoms only (model one), and a second model

including demographics, parent reported symptoms and clinical signs (model two). Both models included 8198/8394 (97.7%) of the children in the cohort. Model one identified four predictors with p<0.001: illness deterioration recently before consultation (OR:2.11, 95%CI:1.89-2.34) and three parent reported symptoms (in order of importance: severe fever (OR:3.04, 95%CI:2.52-3.67), breathing quickly (OR:1.78 95%CI:1.61-1.98) and change in cry (OR:1.29 95%CI:1.14-1.46),), with a combined AUROC of 0.67 (95% C.I. 0.66-0.68, Table 4). Adding clinical examination did not change model one factors included and identified six additional signs (in order of importance: inter/subcostal recession (OR:4.91 95%CI:3.54-6.82), crackles/crepitation (OR:4.79 95%CI:4.18-5.50), nasal flaring (OR:3.08 95%CI:1.76-5.41), wheeze (OR:2.31 95%CI:1.98-2.68), irritability/drowsiness (OR:1.91 95%CI:1.22-2.99), and pallor (OR:0.58 95%CI:0.49-0.70)). Together these gave an AUROC of 0.79 (95% C.I.0.78-0.80, Table 4). As clinicians were only able to take the oxygen saturation level for just over half the children recruited (n= 4194, 51%) a multivariable model was derived using this smaller number of children. This sensitivity analysis did not substantially change the final models.

Discussion

Main findings

Parent and clinician global severity illness assessment differed, with parents considering their child more severely unwell than clinicians. Factors associated with illness severity also differed between parents and clinicians, with parents relying on symptoms and clinician's physical examination findings. That said, the symptoms 'severe fever' and 'breathing quickly' were both important for both parents and clinicians.

Strengths and limitations

We used data from a well characterised, large, representative cohort of children presenting to primary care with the most common problem managed by health services. Participating children had similar levels of overall illness severity than those who were invited but declined study participation. Baseline characteristics were pragmatic, measured according to routine clinical practice and with high level of completeness. The main outcome is clinically relevant, and we used a stringent model retention criterion ($p<0.01$) because of the many candidate predictors. The study question described in this paper was not the focus of the cohort study but a secondary hypothesis.

The main limitation is use of the visual analogue scale (VAS) to measure illness severity. VAS provide a simple technique for measuring subjective experience and has been established as valid and reliable in a range of clinical and research applications.(13) Although ease of use is frequently cited as a major advantage over other scales, others point out that it requires the ability to transform a complex assessment into a vision-spatial display, involving perceptual judgement and accuracy.(17) We used a VAS anchored by zero (well) and ten (very unwell). During decision making, anchoring occurs when individuals use an initial piece of information to make subsequent judgments. Once an anchor is set, other judgments are made by adjusting away from that anchor. Anchor points of parents and clinicians might differ as clinicians are probably used to seeing many more ill children (NB: none of the clinicians

gave a 10/10 (very unwell)), which might lead to a lower score of illness severity in general. Therefore, the poor agreement we found between parents and clinicians might be partly due to anchoring. However, agreement remained poor when we adjusted for changes in anchoring, and we found different parent and clinician factors associated with high severity scores.

Information on any prior assessment (e.g. GP triage, NHS 111 triage, pharmacist recommendation) which might have influenced parent's decision to consult a GP has not been included in our analyses, this, however, could have consequently influenced the parent's illness severity assessment.

Another limitation is that we were not able comparing like with like in that the parents did not clinically examine the child and might not bet aware of signs such as 'inter/subcostal recession', although parents are taught to look out for signs of respiratory distress by GPs and 111 in general . Therefore, modelling the drivers of severity scores was always going to give different results. However, this reflects the actual situation parents and clinicians must navigate in.

omparison with existing literature

The poor agreement in parental and clinician illness of severity assessment found in the present study is consistent with the results of a previous systematic review of qualitative evidence on the interaction of primary care consultations for children with acute minor illnesses.(18) This review concluded that common misunderstandings occur when parents and clinicians speak about the 'seriousness' of the illness, with parents and clinicians talking at cross purposes: parents are seeking to justify their decision to consult, while family physicians seek to justify non-antibiotic treatment strategies.

Although our analysis showed that clinicians do consider parent reported symptoms, they seem to rely much on the clinical examination. Our exploratory analysis on the correlation between the number of symptoms and signs reported and the illness of severity scores showed that the number of parent-reported symptoms does not influence the parental score, but that the number of clinical signs does influence the clinician score. We therefore think that the type of parent-reported symptom is probably more important than the number, but that for clinicians it could be 'the more clinical signs

the more they worry' (meaning a higher score). This is consistent with qualitative evidence (5) showing that GPs not only rely on the initial assessment but feel the need for a more deductive assessment, including physical examination to refine their diagnosis and to rule out serious illness. A study of Blacklock et al. on which symptoms and clinical features correctly identify serious respiratory infection in children attending a paediatric assessment unit shows that parent-reported symptoms were unreliable discriminators of serious acute respiratory infection in children. Nurse trial assessment of respiratory distress and some vital signs are found to be important predictors, which is in line with our findings.(19)

The main analyses from this cohort study found parent reported fever, and clinician measured inter- or sub-costal recession, as well as wheeze on auscultation are prognostically significant – these factors have predictive utility in identifying children at risk of future hospitalisation resulting from their RTI.(12) These factors are also included as intermediate/red flags in the NICE Traffic light system for identifying risk of serious illness (Fever (moderate and high), inter/sub-costal recession (high) and wheeze (moderate)) (20)
It is possible that parents have intuitively identified these factors as important, and therefore also use them to assess illness severity.

No explanation was found in literature that could explain the counterintuitive findings of pallor and one child in the home being associated with lower illness severity scores. Contrary to our finding, pallor is one of the red flag symptoms in NICE Traffic light system for identifying risk of serious illness in children with feverish illness.

Implications for policy, teaching and clinical practice

Interventions to promote self-care (one of the corner stones of NHS sustainability strategy) should take account of the parent concerns likely to be the main drivers of parent help seeking. For example, some symptoms of importance to parents ('severe dry cough', 'reduced eating' and 'disturbed sleep') have not shown to be predictive of poor outcome (12) and may be important targets for reassurance-e.g.odds of a parent perceiving illness to be severe is 14% to 52% higher for parents where the child's sleep has been disturbed but disturbed sleep was not a predictor of disease illness for clinicians. Moreover, how to identify and address these concerns should be included in primary care clinician (medical and nursing) training programmes, as recommended by the recently published Health Education England 'Tackling Antimicrobial Resistance' strategy document (21).

Our study showed that fever is associated with both high parent and clinician severity scores. Education on fever management for parents on the one side and clinicians on the other side is key to make better informed decisions as to when (or if) to consult and to improve parent-clinician communication. In some cases, parent concerns regarding fever are the result of lack of experience and knowledge about fever.(22, 23) Empowering parents and teaching them about alarm symptoms could ameliorate illness anxiety and possibly improve use of primary care services.(24) Advice on self-management for parents and carers could be provided to help patients to self-manage the fever (25). However, as severe fever in a primary care setting is also associated with serious infection(26), parents might be correct to be concerned. Therefore, fever and fever management should be an important item in (NICE) guidelines and telephone triage protocols (NHS 111) on acute respiratory tract infections.

Conclusions

Clinicians need to recognise that parents reach different conclusions, using different factors, when making judgements about illness severity. Improved understanding of the factors concerning parents could improve parent-clinician communication, improve the quality of consultations and thereby child

health outcomes. Understanding parents' concerns and educating them about clinician's concerns need to be part of day to day practice. Balancing the two is essential to successful management of patients with minor infection. Parent education should continue to be an important element of clinical care.

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Ethical approval: body giving ethics approval with reference number where appropriate

The study was approved by the South West Central Bristol Research Ethics Committee, UK (reference number 10/H0102/54)

Competing interests

All other authors declare no competing interests.

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Table 1. Characteristics of children and parents (Total N=8394)

	N	Median	IQR
Age child (years)	8394	3	1-6
Number of children in home	8355	2	1-2
Family deprivation score*	8201	16.7	8.8-29.5
Illness duration at recruitment (days)	8390	5	3-10
Number of parent reported symptoms prior to consultation**	8320	7	5-9
Number of parent reported symptoms within 24 hours of consultation**	8229	6	4-8
	N	**Percentage**	
Child's gender (male)	8934	51.6	
Child's ethnicity (white)	8349	78.4	
Mother current smoker	8285	18.0	
Breastfeeding at 3 months	7784	44.2	
Illness got worse recently	8383	66.0	

**The indices for multiple deprivation (IMD) score ranges from around zero (least deprived) to >90 (most deprived). Ethnicity, deprivation score and prevalence of maternal smoking were similar to national figures.*[12 13]

*** Median of positively reported parent-reported symptoms from the CRF out of the possible 20.*

Table 2. Parent and clinician illness severity scores

Severity of illness score	Mean* (SD)	Median	Range	IQR
Parent *(8360/8394, 99.6%)*	5.2 (1.8)	5	0-10	4-7
Clinician *(8368/8394, 99.7%)*	3.1 (1.7)	3	0-9	2-4
	N (total N= 8337**)	**%**		
Parental score **<** clinician score	478	5.7		
Parental score **=** clinician score	1236	14.8		
Parental score **>** clinician score	6623	79.4		

**P<0.0001 (Wilcoxon test score); ** Number of children with parent and clinician score*

Table 3. Univariable associations (p<0.01) with parental and clinician illness severity score

Significant Variables	Parents high severity score (≥ 7)*		Parents normal & low severity score (< 7)		p-value	Clinician high severity score (≥ 4)*		Clinician normal & low severity score (< 4)		p-value
	N	%	N	%		N	%	N	%	
Sociodemographics and past medical history										
Male	†					1578/2938	53.7	1735/5422	50.4	<0.01
Two or more children at home	1,493/2134	70.0	4004/6196	64.6	<0.001	2035/2925	69.6	3457/5397	64.1	<0.001
Illness deteriorated recently before consultation	1742/2143	81.3	3778/6216	61.8	<0.001	2300/2936	78.3	3214/5414	59.4	<0.001
*Current asthma***						308/2938	10.5	437/5422	8.1	<0.001
Parent/carer-reported general symptoms										
Change in cry	498/2132	23.4	880/6207	14.2	<0.001	*634/2930*	*21.6*	*742/5403*	*13.7*	*<0.001*
Breathing quickly	1085/2143	50.6	1885/6223	30.3	<0.001	*1419/2938*	*48.3*	*1549/5419*	*28.6*	*<0.001*
Wheezing/ whistling in the chest	991/2143	46.3	2287/6220	36.8	<0.001	*1395/2937*	*47.5*	*1879/5418*	*34.7*	*<0.001*
Vomiting including after a cough	738/2143	34.4	1603/6233	25.8	<0.001	*933/2938*	*31.8*	*1407/5419*	*26.0*	*<0.001*
Parent/carer-reported symptoms (in the previous 24 hours)										
Severe dry cough	256/2137	12.0	302/6202	4.9	<0.001	242/2931	8.3	319/5401	5.9	<0.001
Severe fever	296/2134	13.9	243/6204	3.9	<0.001	347/2922	11.9	193/5406	3.6	<0.001
Severe disturbed sleep	539/2133	25.3	806/6193	13.0	<0.001	625/2923	21.4	722/5394	13.4	<0.001
Severe reduction in eating	217/2131	10.2	210/6201	3.4	<0.001	252/2918	8.6	177/5405	3.3	<0.001
Breathing quickly	712/2137	33.3	916/6216	14.7	<0.001	852/2934	29.0	777/5410	14.4	<0.001
Moderate-to-severe wheezing in chest	581/2141	27.1	1033/6211	16.6	<0.001	784/2931	26.8	827/5412	15.3	<0.001
Moderate-to-severe diarrhoea	126/2143	5.9	216/6216	3.5	<0.001					
Moderate-to-severe vomiting (incl. after a cough)	316/2138	14.8	521/6219	8.4	<0.001	340/2934	11.6	496/5414	9.2	<0.001
Moderate-to-severe reduced fluid intake	467/2133	21.9	688/6212	11.1	<0.001	551/2924	18.8	601/5412	11.1	<0.001
Moderate-to-severe reduction in urine passed	202/2132	9.5	260/6206	4.2	<0.001	261/2931	8.9	203/5401	3.8	<0.001
General clinical examination										
Pallor	‡		‡			331/2934	11.3	489/5416	9.0	<0.001
Grunting						59/2933	2.0	16/5416	0.3	<0.001
Nasal flaring						79/2934	2.7	22/5417	0.4	<0.001
Temperature ≥ 37.8°C						690/2929	23.6	351/5409	6.5	<0.001
Raised respiratory rate (age-related cut-offs)						681/2932	23.3	560/5395	10.4	<0.001
Low oxygen saturation (≤95%)						234/1378	16.9	167/2804	6.0	<0.001
irritable or drowsy						88/2936	3.0	29/5413	0.7	<0.001
Clinician gut feeling that something was wrong						1213/2931	41.4	483/5413	8.9	<0.001
Stridor						7/933	0.92	15/54145	0.8	<0.001
Inflamed pharynx/tonsils						1096/928	37.4	187/5403	3.8	<0.001
Chest examination										
Wheeze	‡		‡			776/2931	26.5	454/5416	8.4	<0.001
Crackles/crepitations						1140/2932	38.9	452/5415	8.4	<0.001
Raised respiratory rate (age-related cut-offs)						681/2932	23.3	560/5395	10.4	<0.001

Inter/subcostal recession						350/2934	11.9	53/5416	1.0	<0.001

** based on upper quartile of total dataset (N=8394); **defined as present if asthma in medical notes and asthma drug issued in the previous 12 months; † not significantly associated; ‡ parents were not expected to clinically examine their child.*

Table 4. Final multivariable predictors of high parental illness of severity score and high clinician illness of severity score (all p<0.01)

		Illness of severity score						
		High parent score (≥ 7) (‡AUROC= 0.68, 95% CI= 0.66-0.69)			**High clinician score (≥ 4)** (‡AUROC= 0.67, 95% CI= 0.66-0.68)		**High clinician score (≥ 4)** (‡AUROC= 0.79, 95% CI=0.79-0.80)	
		Model 1 (Demographics & symptoms)			**Model 1** (Demographics & symptoms)		**Model 2** (Demographics, symptoms & clinical signs)	
	Source	**Odds ratio**	**95% CI**		**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
Sociodemographic								
2 or more children at home	Parent	1.28	1.15-1.44		†		†	
Clinical history								
Illness deteriorated recently before consultation	Parent	†			2.11	1.89-2.34	1.90	1.69-2.13
Symptoms								
Change in cry	Parent	1.30	1.13-1.49		1.29	1.14-1.46	1.39	1.21-1.59
*Breathing quickly/ raised respiratory rate**	Parent/clinician	1.88	1.69-2.10		1.78	1.61-1.98	1.43	1.28-1.59
Severe fever / temperature ≥ 37.8°C	Parent/clinician	2.58	2.12-3.13		3.04	2.52-3.67	3.58	3.12-4.10
Severe dry cough	Parent	1.93	1.60-2.34		†		†	
Severe disturbed sleep	Parent	1.32	1.14-1.52		†		†	
Severe reduced eating	Parent	1.58	1.26-1.98		†		†	
Moderate-to-severe reduced fluid intake	Parent	1.55	1.34-1.80		†		†	
Clinical examination								
Pallor	Clinician						0.58	0.49-0.70
Irritable or drowsy	Clinician						1.91	1.22-2.99
Nasal flaring	Clinician						3.08	1.76-5.41
Inter/subcostal recession	Clinician						4.91	3.54-6.82
Wheeze	Clinician						2.31	1.98-2.68
Crackles/crepitations	Clinician						4.79	4.18-5.50

**age-related cut-offs: † p≥0.01; ‡ AUROC: Area Under the Receiver Operating Characteristic curve.*

Figure 1. Distribution of illness severity scores

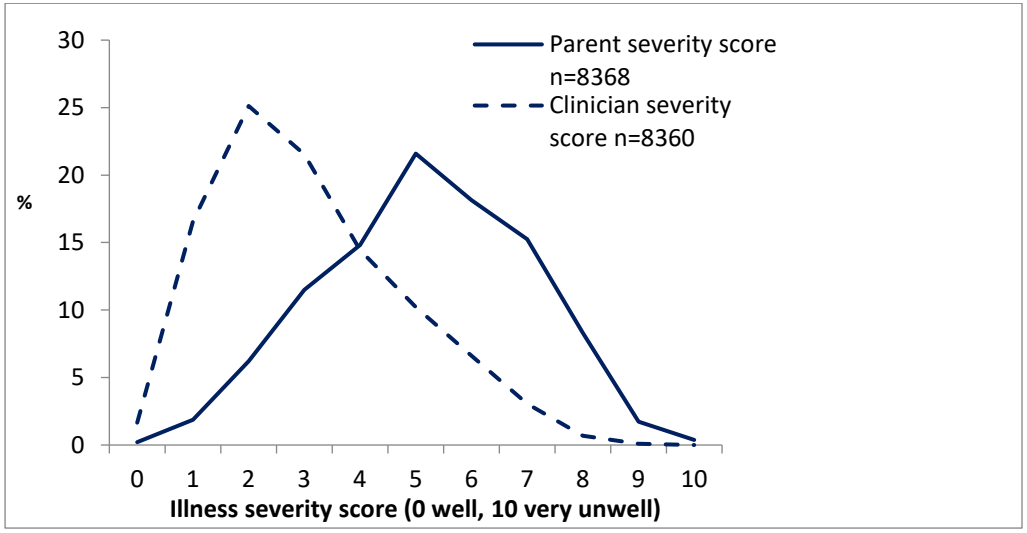

Figure 2. Comparing illness severity score of child between clinician and parent

Parent-reported illness severity	**Clinician-reported illness severity**											
	0	1	2	3	4	5	6	7	8	9	10	Total
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
2	0%	3%	3%	0%	0%	0%	0%	0%	0%	0%	0%	6%
3	0%	3%	4%	3%	1%	0%	0%	0%	0%	0%	0%	12%
4	0%	3%	5%	4%	2%	1%	0%	0%	0%	0%	0%	15%
5	0%	3%	5%	5%	4%	3%	1%	0%	0%	0%	0%	22%
6	0%	1%	4%	4%	4%	3%	2%	0%	0%	0%	0%	18%
7	0%	1%	3%	3%	3%	2%	2%	1%	0%	0%	0%	15%
8	0%	1%	1%	2%	1%	1%	1%	1%	0%	0%	0%	8%
9	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total	2%	17%	25%	22%	14%	10%	7%	3%	1%	0%	0%	100%

Percentages rounded to the nearest whole number/ 'white' representing 0% to the 'darkest blue' representing 5% of children got a similar score by parent as clinician.

Inter rater agreement:
Parental score – Clinician score : 14.8%, Kappa= 0.049
Parental score – Clinician score + 2* : 20.6%, Kappa= 0.064
**to control for anchoring, the rounded mean difference between the parental score and clinician score was added to the clinician score*